PRODUCTION ENGINEERING LABORATORY — SECTION 2

Lifting and Floor Accessories

Restoration, Function, and Field Reference

Restored tools — Production Engineering Laboratory, DUIET

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1. Introduction

This document covers the lifting and rig-floor handling tools restored as part of the Production Engineering Laboratory development exercise. These tools are used to raise, lower, suspend, and safely handle the drill string, casing, or tubing during tripping and connection operations. Each entry includes function, working principle, a schematic showing the tool's position in the handling sequence, and QR-linked video/reference material.

2. Elevator

A drilling elevator is a hinged steel clamp that latches around a section of drill pipe, casing, or tubing just below its tool joint or coupling, allowing the entire string to be lifted, lowered, and suspended from the travelling block via the elevator links (bails).

2.1 Working Principle

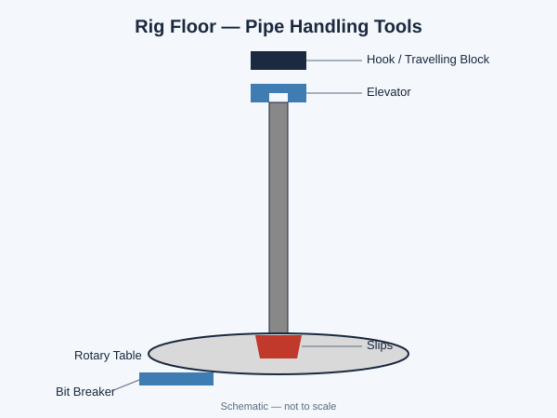
The elevator's bore is tapered to match the upset or coupling shoulder of the pipe being run, so that when the elevator is lowered onto the string, the shoulder rests against the elevator's internal taper and transfers the full hanging weight of the string into the elevator body, and from there up through the bails to the hook and travelling block. Elevators are hinged so they can be opened, latched around the pipe, and closed without needing to thread the pipe through a closed loop.

2.2 Field Note

Because elevators are sized for a specific pipe OD and upset profile, the correct elevator must be selected for each string being run; using a mismatched elevator risks the pipe slipping through or the elevator failing to seat correctly.

2.3 Restored Tool — Photograph & Schematic

Elevator, restored — Production Engineering Laboratory, DUIET



Elevator position in the hoisting system

2.4 Video & Reference — Scan to Access

Scan: Video

Scan: Reference

[Video: Essential Handling Tools — Elevators (YouTube)]

[Reference: What Are Drilling Slips & Elevators? (Texas International)]

3. Slips

Slips are wedge-shaped, hinged segments lined with toothed (serrated) gripping inserts. They are set into the tapered bowl of the rotary table (or used as hand slips) to hold the drill string, casing, or tubing suspended in the wellbore while a connection is made up or broken out.

3.1 Working Principle

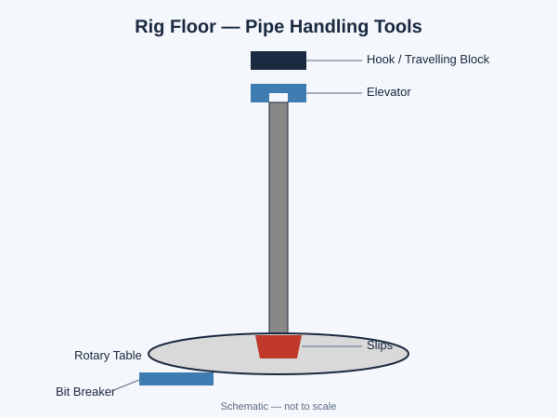
As the pipe is lowered and the weight of the suspended string settles onto the slips, the taper of the slip bodies wedges them tighter against both the pipe and the rotary table bushing — the more weight applied, the tighter the grip. This self-energising wedge action distributes the holding load evenly around the pipe circumference, gripping firmly without crushing thinner-walled tubulars.

3.2 Field Note

With very little weight initially resting in the slips (for example, just after starting to run the first joints), the bite may not yet be sufficient and the string can slip — this is precisely the failure mode that the dog collar / safety clamp (Section 4) is designed to back up.

3.3 Restored Tool — Photograph & Schematic

Slips, restored — Production Engineering Laboratory, DUIET



Slips set in the rotary table (schematic)

3.4 Video & Reference — Scan to Access

Scan: Video

Scan: Reference

Video: Slips and Elevator Systems — drilling rig lessons (YouTube)

Reference: Oil and Gas Well Drilling and Servicing eTool (OSHA)

4. Bit Breaker

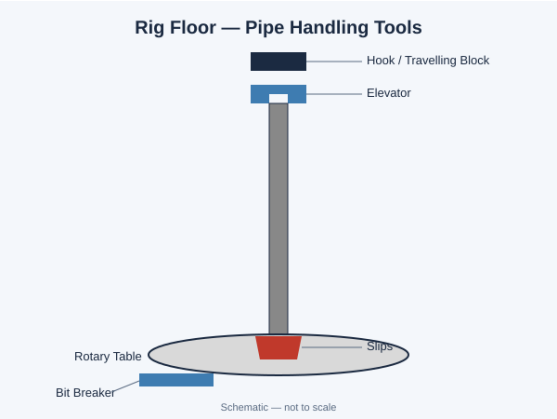
A bit breaker is a heavy, shaped steel fixture that sits in the rotary table and holds the drill bit stationary by its pin/shank profile while the drill collar or drill pipe above it is torqued up (made up) or broken loose (broken out).

4.1 Working Principle

The bit breaker's socket is precisely machined to match the bit's specific connection profile, so that when torque is applied at the connection above, the reaction torque is transmitted into the bit breaker and held by the rotary table rather than spinning the bit itself. This prevents damage to the bit cutting structure that could occur if the bit were allowed to rotate during make-up or break-out.

4.2 Restored Tool — Photograph & Schematic

Bit Breaker, restored — Production Engineering Laboratory, DUIET



Bit breaker position at rotary table

4.3 Video & Reference — Scan to Access

Scan: Video

Scan: Reference

Video: Bit breaker drilling rig floor — search (YouTube)

Reference: Type C Safety Clamps & Handling Tools (Arabian Drilling Tools)

5. Dog Collar (Safety Clamp)

A dog collar, also called a safety clamp, is a split, bolted (or spring-loaded link) collar fitted around the drill string just above the rotary table or below the elevator. It serves as a secondary, backup safety device.

5.1 Working Principle

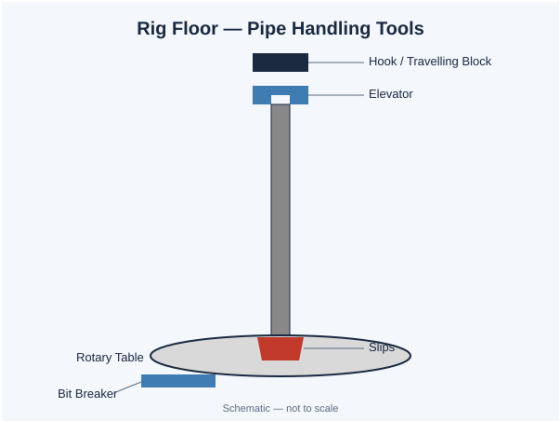
Each link of the safety clamp carries its own spring-loaded, toothed insert. Under normal conditions the clamp simply rides on the pipe without bearing load. If the primary gripping device (slips or elevator) were to lose its grip, the falling string would be caught as the clamp's teeth bite and wedge tighter under the sudden load, arresting the fall before the string could drop into the wellbore.

5.2 Important Safe-Use Notes

- A safety clamp is a backup device only — it must never be used as the primary lifting or hoisting device.
- It should not be used together with automated power slips, as the combination can create a hazard rather than improve safety.

5.3 Restored Tool — Photograph & Schematic

Dog Collar / Safety Clamp, restored — Production Engineering Laboratory, DUIET



Safety clamp position on drill string

5.4 Video & Reference — Scan to Access

Scan: Video

Scan: Reference

Video: Safety clamp / dog collar — search (YouTube)

Reference: A Guide to Safety Clamps (DrillingParts.com)

6. Drilling Line and Piano Wire

6.1 Drilling Line

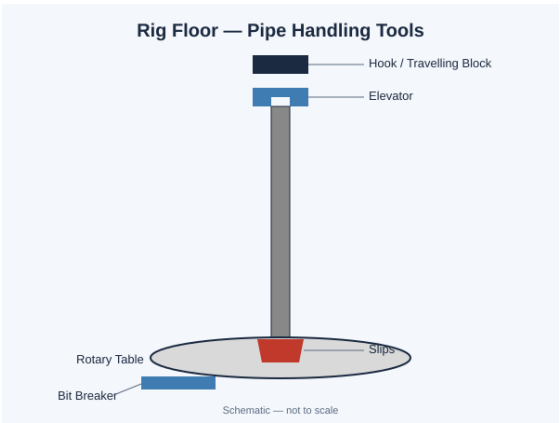
Drilling line is the high-strength steel wire rope reeved through the sheaves of the crown block and travelling block. It is spooled on the drawworks drum and is used to raise and lower the travelling block, hook, and everything suspended from it — elevators, drill string, and casing. Because wear concentrates at specific points where the line bends over the sheaves, the line is periodically "slipped and cut" (fed through and trimmed) to redistribute wear and extend service life.

6.2 Piano Wire

Piano wire (referred to in some field contexts as measuring or sand line) is a thin, high-tensile steel wire used in well-servicing for light-duty applications such as depth measurement, gauge runs, or conveying small mechanical tools where a full wireline unit is not required.

6.3 Restored Tools — Photograph & Schematic

Piano wire and drilling line, restored and coiled



Drilling line in the hoisting system

6.4 Video & Reference — Scan to Access

Scan: Video

Scan: Reference

Video: Drilling line slip and cut procedure — search (YouTube)

Reference: IADC — International Association of Drilling Contractors

7. Summary Table

Tool	Primary Function	Used At
Elevator	Latches pipe to lift/lower/suspend the string	Below the hook/travelling block
Slips	Wedge-grips pipe to suspend it in rotary table	Rotary table
Bit Breaker	Holds bit stationary during make-up/break-out	Rotary table
Dog Collar	Backup safety device against dropped string	Above rotary table
Drilling Line	Wire rope that hoists the travelling block	Crown block to drawworks
Piano Wire	Light-duty depth measurement / small tool runs	Well-servicing operations

This concludes Section 2 of the Production Engineering Laboratory tool reference series.